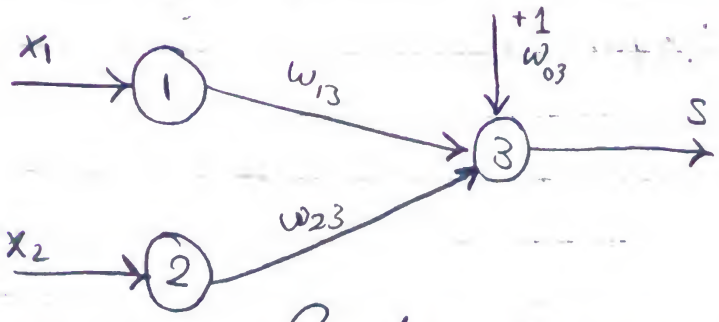
8



* Activation Function (Threshold function)

$$S = \begin{cases} 1 & y \geq 0 \\ 0 & y < 0 \end{cases}$$

$w_{13} = 2$, $w_{23} = 2$, $w_{03} = -1.5$

① $x_1 = x_2 = 0$

$y = x_1 w_{13} + x_2 w_{23} + w_{03}$

$= 2x_1 + 2x_2 - 1.5$

$= -1.5 < 0 \Rightarrow \boxed{S = 0}$

② $x_1 = 0$; $x_2 = 1$

$y = (2)(0) + (2)(1) - 1.5$

$= 0.5 > 0 \rightarrow \boxed{S = 1}$

③ $x_1 = 1$; $x_2 = 0$

$y = 0.5 \Rightarrow \boxed{S = 1}$

④ $x_1 = x_2 = 1$

$y = 2.5 \Rightarrow \boxed{S = 1}$

OR

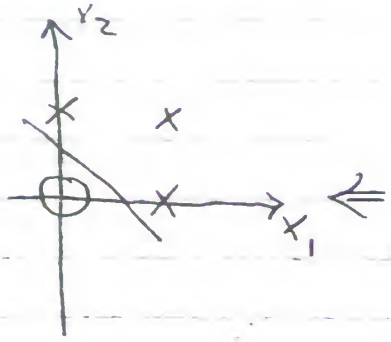
input		output
x_1	x_2	S
0	0	0
0	1	1
1	0	1
1	1	1

Design ANN :-

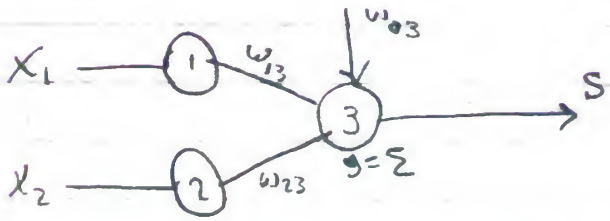
1. i/p , o/p
2. Linearity ? (determine hidden Layer)
3. no. of Hidden Layer neurons.
4. Activation function / neuron
5. weights ⇐ Learning Algorithms

Design OR

1. i/p = 2 o/p = 2
2. "Linear" use no hidden Layers
3. 1 neuron
4. Threshold function



x_1	x_2	S	
0	0	0	0
0	1	1	X
1	0	1	X
1	1	1	X



$$y = w_{13} x_1 + w_{23} x_2 + w_{03}$$

① $x_1 = 0$, $x_2 = 0$ $\longrightarrow S = 0$

$y = w_{03} < 0$

$w_{03} = -A$ (A is Positive)

② $x_1 = 0$, $x_2 = 1$ $\longrightarrow S = 1$

$y = w_{23} + w_{03} > 0$

$\Rightarrow w_{23} > A$

[3] $x_1 = 1 \quad x_2 = 0 \longrightarrow S = 1$

$y = w_{13} + w_{03} > 0$

$w_{13} > A$

[4] $x_1 = 1 \quad x_2 = 1$

$y = w_{13} + w_{23} + w_{03} > 0$

$w_{13} + w_{23} > A$

So, we can put $w_{13} = 12$; $w_{23} = 11$

$w_{03} = -10$

For AND; follow the same steps but change weights

$w_{03} = -10$, $w_{13} = 3$ $w_{23} = 8$

$y = w_{13} + w_{23} > A$ (and truth table)

(1) $x_1 = x_2 = 0 \longrightarrow S = 0$

$y = w_{03} < 0 \Rightarrow w_{03} = -A$

(2) $x_1 = 0$; $x_2 = 1 \longrightarrow S = 0$

$y = w_{23} + w_{03} < 0$

$w_{23} < A$

(3) $x_1 = 1$; $x_2 = 0 \longrightarrow S = 0$

$y = w_{13} + w_{03} < 0$

$w_{13} < A$

(4) $x_1 = x_2 = 0 \longrightarrow S = 1$

$y = w_{13} + w_{23} + w_{03} > 0$

$w_{13} + w_{23} > A$

* for NAND ; NOR just multiply weights by -1

AND $\Rightarrow w_{13} = -2$, $w_{23} = -2$, $w_{03} = 3$

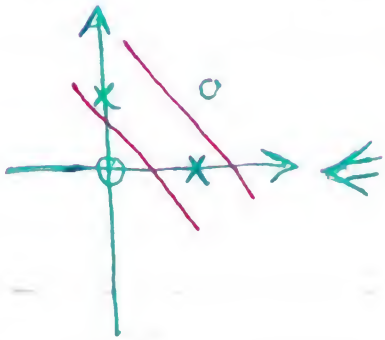
NOR $\Rightarrow$ $w_{13} = -2$, $w_{23} = -2$, $w_{03} = 1$

* XOR

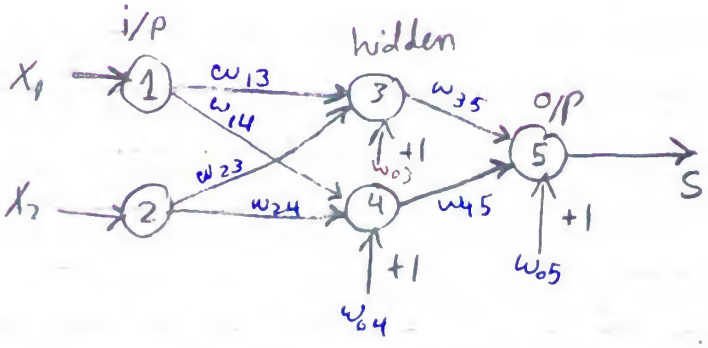
"non-Linear"

13

XOR $\nexists w_i$'s



x_1	x_2	S
0	0	0
0	1	1
1	0	1
1	1	0



$w_{13} = 2$, $w_{24} = 2$ $w_{03} = -1.5$, $w_{23} = -1$

$w_{14} = -1$, $w_{35} = 2$ $w_{04} = -1.5$; $w_{45} = 2$

$w_{05} = -1.5$

$z_3 = f(y_3)$, $z_4 = f(y_4)$ $S = f(y_5)$

$y_3 = 2x_1 - x_2 - 1.5$

$y_4 = -x_1 + 2x_1 - 1.5$

$z_3 = f(y_3)$, $z_4 = f(y_4)$

$y_5 = 2z_3 + 2z_4 - 1.5$

$S = f(y_5)$

① $x_1 = x_2 = 0$

$y_3 = -1.5 \Rightarrow z_3 = 0$

$y_4 = -1.5 \Rightarrow z_4 = 0$

$y_5 = -1.5 \Rightarrow \boxed{S = 0}$

② $x_1 = 0,\ x_2 = 1$

$y_3 = -2.5 \rightarrow z_3 = 0$

$y_4 = 0.5 \rightarrow z_4 = 1$

$y_5 = 0.5 \rightarrow \boxed{S = 1}$

③ $x_1 = 1,\ x_2 = 0$

$y_3 = 0.5 \rightarrow z_3 = 1$

$y_4 = -2.5 \rightarrow z_4 = 0$

$y_5 = 0.5 \rightarrow S = 1$

④ $x_1 = x_2 = 1$

$y_3 = -0.5 \rightarrow z_3 = 0$

$y_4 = -0.5 \rightarrow z_4 = 0$

$y_5 = -1.5 \rightarrow \boxed{S = 0}$